Method to calculate the operational parameters of a synchronous generator used in a railway diesel electrical traction

G.D. Petropol Serb1, I. Petropol Serb2,
1University of Craiova, Romania, 2 S.C. RELOC S.A. Craiova, Romania

Abstract

The present study aims to accomplish a theoretical synthesis upon the method to calculate the operational parameters of a railway traction synchronous generator, to propose an algorithm and also to implement it into a numeric program which should be easy to use. It could be used by students, engineers, researchers or others interested in developing custom engineering system modelling. In order to assure a continuity of the authors’ research, regarding the modelling of the functional and designing aspects of the synchronous machine, it is desirable the choice of Matlab as a programming medium and the accomplishment of a graphic interface which should allow a permanent dialogue between user and the programming resources. This paper is a next step to put the bases of a PBL (Project Based Learning) method in the area of studying electrical machines. For a systemic and transdisciplinary approach of the research, which should allow it to be the initial point for many and various research objectives, this work starts from the description of the working environment and the interactions of the traction synchronous generator as a component of the diesel electrical transmission. The originality of this work consists in the proposal of the method of calculus which could be used in modern educational languages or in research activity.

As a methodology of study, the performance analysis of the synchronous generator (GST) within the diesel engine - synchronous generator group should be done by analogy with the study algorithm of the direct current generator. To establish the main parameters of the synchronous generator (GST) we need to know: rated power of diesel electrical engine (Pd), engine speed at the drive shaft of the heat engine (n), maximal voltage which is necessary for supplying the asynchronous traction motors at a maximum speed (Ufmax). The parameters of the traction synchronous generator can be constructive (number of poles, number of phases, number of phase windings) or operational (rated phase current \(I_{fn}\) and rated phase voltage \(Unf\) determined for a constant power corresponding to the conventional regime of load of the heat engine). In case of using a synchronous generator of railway traction within the a.c. - d.c. transmissions, its operational parameters, voltage on phase and current on phase, change between \(U_{fmax}-U_{fmin}\) and respectively \(I_{fmin}-I_{fmax}\). For the numerical calculation we are considering an electrical transmission of a.c. - d.c., having a synchronous generator with non salient poles which must follow a similar operating external characteristic of the main direct current generator within the 060 DA locomotive.

The steps to create the interface to calculate the operational parameters of the synchronous generator used in diesel electrical railway traction are: model definition; system decomposition; laying out the GUI components; programming the GUI components; create a scenario to use it in PBL (Project Based Learning) units. This interface could be a model for a subject developed in a unit of learning of a PBL method. To run or developed this interface, the learners (a group of three or four students [7]) needs to know the scientific background of the subject. The usage of the numerical methods and the graphical representation allows a quick and easy interaction between the user and the data bases. It can be successfully used for designing team work scenarios and also for training the professionals in the field. The opportunity of this work is sustained by the imperious need to organize in an efficient way the extended information acquired by researching in the area of electromechanical systems.

![Figure 1. GUIDE components: programming steps and running interface](image)

References